

Light Localization Based Integrated Optics in 3+1 Dimensions

A. Chutinan and S. John

Department of Physics, University of Toronto, 60 St. George St., Toronto, Canada

We demonstrate on-chip single-mode, waveguiding of light in air for a variety of two- and three-dimensional (2D–3D) photonic band gap (PBG) heterostructures. These include square spiral, woodpile, slanted pore, and inverse opal 3D photonic crystals intercalated with a 2D (planar) photonic crystal microchip. The general design rules for a high-bandwidth waveguide that require matching of the fields at the interfaces between the structures with different dimensionality are identified and physical interpretation is given. Our design allows stacking multiple layers of the planar photonic crystal microchip layers in a small 3D volume. Interconnects between these microchip layers can be achieved by appropriate vertical waveguides.

- [1] A. Chutinan and S. John, *Phys. Rev. Lett.*, **90**, 123901 (2003).
- [2] A. Chutinan and S. John, *Photonics and Nanostructures*, **2**, 41 (2004).
- [3] A. Chutinan and S. John, *Phys. Rev. E*, in press.